AS Computer Science – unit 6 Data Types Final Assessment Test 02/12/2024

Name: Group: Mark: /50 Grade:

1. Binary values are extensively used within computer systems.

   (a) What is the binary equivalent of the decimal number 231_{10}? Show your working. [2]

   (b) Hexadecimal values provide a summary of groups of binary digits. Convert the binary value 10101100_2 into hexadecimal. Show your working [2]

   (c) Represent the decimal value 2.75_{10} as an unsigned binary fixed point number, with the most significant 4 bits as the whole number part and the remaining 4 bits as the fractional part after the binary point. [2]

   (d) Two's complement binary is used to represent negative values.

   Represent -121_{10} as an 8-bit two's complement binary value. [2]

   (e) Use two's complement 8-bit binary to calculate the answer to $98_{10} - 22_{10}$. Show your working. [4]

2. ASCII is a system used to represent characters in a computer system using a predetermined character set.

   What is meant by a character set? [1]

   (a) The ASCII code for the letter b is 1100010_2. How would the word "cab" be represented in 8-bit ASCII? [2]

   (b) **Unicode** character encoding is used as an alternative coding system due to its larger character set. Explain why the ASCII character set is unsuitable in the modern world. [2]

3. MAC addresses are used to uniquely identify network enabled hardware devices. They are written in the format of six pairs of hexadecimal digits: 3A:D2:48:9E:61:AC.

   a. Convert the first pair of digits 3A to binary. [2]

   b. How many bytes will this MAC address occupy in a computer's memory? [1]

   c. Explain why a MAC address is expressed in hexadecimal rather than pure binary. [1]

4. The 7-bit ASCII representations of the digits 0-9 are 011 0000 to 011 1001.

   (a) What is the ASCII representation of the number 3? [1]

   (b) Convert this representation to denary. [1]

   (c) The 7-bit ASCII representations of the letters A – Z are 100 0001 to 101 1010.

   Represent the word BEAD in binary in a 32 bit byte. [3]

5. Below are extracts from the ASCII and EBCDIC character sets.

ASCII

Denary Value	65	66	67	68	69	70	71	72	73	74	75	76	77
Character	A	B	C	D	E	F	G	H	I	J	K	L	M
Denary Value	78	79	80	81	82	83	84	85	86	87	88	89	90
Character	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

EBCDIC

Denary Value	193	194	195	196	197	198	199	200	201	...	209	210	211	212
Character	A	B	C	D	E	F	G	H	I	...	J	K	L	M
Denary Value	213	214	215	216	217	...	226	227	228	229	230	231	232	233
Character	N	O	P	Q	R	...	S	T	U	V	W	X	Y	Z

Explain, referring to ASCII and EBCDIC, what would happen if computers were to use different character sets when communicating.

[2]

6. Asim is the head of a chess club. One of his jobs is to send out a monthly newsletter.

For the newsletter, club members send in descriptions of games they play using chess notation, which consist of a sequence of symbols, letters and numbers. It is important that these descriptions are accurate.

One member sends in the description as a plain text file. The text file is saved using Unicode, an extract of which is shown below.

♙e4 ♟c5

i. Explain what is meant by the term 'Unicode'.

[3]

When Asim opens this file on the text editor on his computer it looks as below.

□e4 □c5

ii. Explain why the text may not be displaying correctly.

[2]

7. Computers store data as bytes.

a. How many bits make up a byte? [1]

b. Add the following unsigned 8-bit binary integers: Show your working. [2]

1	1	1	1	1				
	0	1	1	1	1	1	0	0
	1	0	0	1	1	0	1	1
1	0	0	0	1	0	1	1	1

c. Explain the problem that has resulted from the calculation above using 8 bits. [1]

8. a) Show how the numbers 3 and -9 would be represented in one byte using sign and magnitude. [1]

b) Why is this method of representing negative numbers not commonly used in computer processors? [2]

9(a) Convert the binary number 01101111 to a hexadecimal number.

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.....[1]

(b) Convert the denary number −19 to an 8-bit number using:

(i) Two's complement representation.

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.....[1]

(ii) Sign and Magnitude representation.

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.....[1]

(c) The two values below are stored using unsigned binary. Calculate the subtraction of 01110010 from 11000011.
Show your working.

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11000011
01110010 -
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[2]

(d) Convert the denary number 15/8 (i.e. 1.625) to a normalised floating point binary number using 5 bits for the mantissa and 3 bits for the exponent. Show your working.

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.....[3]

(e) Represent the number 55 in normalised floating point binary notation, with the mantissa and exponent both in two's complement binary, using as few bits as possible.

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.....[2]

END OF PAPER